BUREAU OF WATER

South Carolina Department of Health and Environmental Control

SHELLFISH MANAGEMENT AREA 18

2004 ANNUAL UPDATE

Shellfish Sanitation Program

Water Monitoring, Assessment and Protection Division
Environmental Quality Control - Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201

July 2004

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South Carolina Department of Health and Environmental Control

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2004 ANNUAL UPDATE

[Data Thru December 2003]

Shellfish Management Area 18
Shellfish Sanitation Program

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TABLE OF CONTENTS
Shellfish Management Area 18 Annual Update

Figures and Tables

Figures:

Tables:

ANNUAL UPDATE
Shellfish Management Area 18
SCDHEC EQC Bureau of Water

Data Inclusive Dates:
01/01/01 thru 12/31/03

Classification Change:
__X__ Yes ___No

Shoreline Survey Completed: __Yes__

Prior Report & Date: Annual-2003

(I)ncreased/(D)ecreased/(N)one:
__D__ Approved
__N__ Conditionally Approved
__I__ Restricted
__N__ Prohibited

SUMMARY

The majority of sampling stations in Shellfish Management Area 18 show a decline in water quality (increased values for geometric mean and/or 90th percentile values) subsequent to the previous sanitary survey. The bacteriological water quality data reflects the return to normal rainfall amounts in 2002 and 2003 following the drought conditions the region experienced during the period 1999 to 2001. For this review period, a downward classification (Approved to Restricted) will occur in portions of Area 18.

Water quality at Station 10, the second bridge to Callawassie Island, meets the statistical criteria for a Restricted classification, with an estimated 90th percentile value of 51. The classification of Chechessee Creek between stations 10, 11, and 14 will be downgraded to Restricted.

Water quality at Station 09, at the first (unnamed) tributary in Chechessee Creek from Colleton River, meets the statistical criteria for a Restricted classification, with an estimated 90th percentile value of 44. Water quality at this station is impacted by rainfall and runoff from stormwater ditches in the Bailey's Circle area. The existing Restricted area should remain in place, extending from the west side of the causeway and bridges to Callawassie Island and Station 03, at the confluence with the Okatie River.

Water quality at Station 08, near the headwaters of the Okatie River, meets the statistical criteria for a Restricted classification, with an estimated 90th percentile value of 58. Water quality at Station 08 is impacted by rainfall and stormwater runoff and this moderate downturn in water quality appears to be the result of a return to normal rainfall patterns. The harvesting classification of the Okatie River, from its headwaters to Station 16 will remain Restricted.

Stations 16 and 17 in the Okatie River, although meeting Approved Area criteria, showed a slight decline in water quality (increased values for geometric mean and estimated 90th percentile values) subsequent to the previous Annual Update. The estimated 90th percentile MPN values for stations 16 and 17, 35 and 27, respectively, are approaching the statistical criteria for Restricted classification.

Construction on widening of Highway 170 to four lanes is nearing completion.

INTRODUCTION

PURPOSE AND SCOPE

The authority to regulate the harvest, sanitation, processing and handling of shellfish is granted to the South Carolina Department of Health and Environmental Control by Section 44-1-140 of the Code of Laws of South Carolina, 1976, as amended. The Department promulgated Regulation 61-47 which provides the rules used to implement this authority and outlines the requirements applied in regulating shellfish sanitation in the State This regulation specifically addresses classification of shellfish harvesting areas and requires that all areas be examined by sanitary and bacteriological surveys and classified into an appropriate shellfish harvesting classification.

The National Shellfish Sanitation Program (NSSP) Guide For The Control Of Molluscan Shellfish is used by the United States Food and Drug Administration (USFDA) to evaluate state shellfish sanitation programs. The NSSP Model Ordinance requires that a sanitary survey be in place for each growing area prior to its use as a source of shellfish for human consumption and prior to the area's classification as Approved, Conditionally Approved, Restricted, or Conditionally Restricted. Each sanitary survey shall be updated on an annual basis and accurately reflect changes which have occurred within the area. Requirement of the annual reevaluation include, at a minimum, field observations of pollution sources, an analysis of water quality data consisting of the past year's data in combination with appropriate previously collected data, review of reports and effluent samples from pollution sources, and review of performance standards for discharges impacting the growing area. A brief report documenting the findings shall also be provided.

The following criteria consistent with the NSSP Model Ordinance and S. C. Regulation 61-47 are used in establishing shellfish harvesting classifications:

Approved - Growing areas shall be classified Approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations which would render shellfish unsafe for human consumption. The Approved area classification shall be designated based upon a sanitary survey which includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, and not more than ten percent of the samples shall exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform Most Probable Number (MPN) shall not exceed fourteen per one hundred milliliters, and the estimated ninetieth percentile shall not exceed an MPN of forty three (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP

Guidelines.

Conditionally Approved - Growing areas may be classified Conditionally Approved when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be adopted by the Department prior to classifying an area as Conditionally Approved. Where appropriate, the management plan for each Conditionally Approved area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems, evaluation of each source of pollution, and means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate.

Restricted - Growing areas shall be classified Restricted when sanitary survey data show a limited degree of pollution or the presence of deleterious or poisonous substances to a degree which may cause the water quality to fluctuate unpredictably or at such a frequency that a Conditionally Approved classification is not feasible. Shellfish may be harvested from areas classified as Restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. For Restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Conditionally Restricted - Growing areas may be classified Conditionally Restricted when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be prepared by the Department prior to classifying an area as Conditionally Restricted. Where appropriate, the management plans for each Conditionally Restricted area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems and an evaluation of each source of pollution) and description of the means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish may be harvested from areas classified as Conditionally Restricted only for the purposes of relaying or depuration and only by permit issued by the Department and under Department supervision. For Conditionally Restricted areas to be utilized as a source of

shellstock for depuration, the fecal coliform geometric mean MPN of Conditionally Restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Prohibited - Growing areas are classified Prohibited if there is no current sanitary survey or if the sanitary survey or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or indicate that such substances could potentially reach quantities which could render shellfish unfit or unsafe for human consumption.

BACKGROUND INFORMATION

Shellfish Management Area 18 consists of 12,118 acres of shellfish growing area habitat in Beaufort County. It is comprised of the Colleton and Okatie Rivers and their tributaries including Chechessee, Callawassie, and Sawmill Creeks. Most of the shellfish resources and harvesting activity is located in the lower portion of the Okatie and in the Colleton River.

The area's northern boundary runs between the intersection of Highway 170 and Highway 278 and the Chechessee River. The eastern boundary runs along the western shore of the Chechessee River to the mouth of Colleton River then to Highway 278. Highway 278 defines the area's southern boundary. The western boundary runs along Highway 170/278. Much of the southern boundary area along Highway 278 is comprised of golf course plantations. This area is experiencing a significant increase in residential and commercial development.

The harvesting classifications of Area 18 prior to this survey were as follows:

Prohibited: None

Restricted/No Depuration: None

Restricted:

1) Chechessee Creek, from Station 03 at its confluence with Okatie River, to the bridge to Callawassie Island.
2) Okatie River, from its headwaters to Station 16, at the confluence of the Pinckney Colony tributary

Approved: The remaining waters of Area 18.

Station Addition/Deactivation/Modification: None.

The shellfish industry in South Carolina is based mainly on the harvest of the eastern oyster *(Crassostrea virginica)* and hard clams *(Mercenaria mercenaria)*. Areas in South Carolina designated for commercial harvest by the South Carolina Department of Natural Resources (SCDNR) include state shellfish grounds, culture permits, mariculture permits, and Kings Grant areas. There are two shellfish culture permits in Area 18. Culture permit 054 is leased to L.P. Maggioni & Company; and 057 is leased to T.M. Bailey (and subleased to Maggioni). The general public is allowed to harvest on one state shellfish ground in Area 18 -
S-058 - which is located in Chechessee Creek. Recreational harvesting is allowed for clams and oysters in this area, and commercial harvesting by licensed individuals is currently allowed, subject to seasons established by SCDNR. Recreational harvesting only is allowed on the Chechessee Bluff Public Shellfish Ground in Chechessee Creek.

Shellfish harvesting season in South Carolina extends from September 16 through May 15, although actual dates may vary. SCDNR has the authority to alter the shellfish harvesting season for management purposes. The South Carolina Department of Health and Environmental Control has the authority to prohibit shellfish harvesting when necessary to ensure that all shellfish harvested in South Carolina waters are safe for human consumption.

POLLUTION SOURCE SURVEY

SURVEY PROCEDURES

Shoreline surveys of Area 18 were conducted by the Low Country District Shellfish Sanitation staff**,** by watercraft, vehicle, and on foot, during the survey period and are ongoing.

POINT SOURCE POLLUTION

Major sources of actual or potential pollution (See Figure 4)

PERMITTED SOURCES	PERMIT #/TYPE/ DISCHARGE
Callawassie Island WWTP	ND0062235/spray irrigation
Spring Island WWTP	ND0077828/spray irrigation

A. Municipal and Community Waste Treatment Facilities - Most of the wastewater facilities are located outside of the boundary of Area 18 and therefore are not shown on the map of Potential Pollution Sources. However, treated effluent from these plants is typically disposed of on golf courses in Area 18.

The Beaufort Jasper Water & Sewer Authority (BJWSA) Okatie Water Reclamation Facility (SC0047279 and ND007404), located in Shellfish Management Area 19, is permitted

to dispose of treated effluent at Island West Golf course, Indigo Plantation, Del Webb, and Rose Hill Plantation in Area 18. The plant also has two permitted discharges (SC0047279) to the Great Swamp wetlands to the New River and Dell Webb's Sun City Hilton Head wetlands to the New River.

Callawassie Island WWTP is a 0.26 MGD plant that disposes of its treated effluent on its golf course. Spring Island WWTP is a 0.0525 MGD plant which utilizes spray irrigation to dispose of treated effluent onto 150 acres at the Old Tabby Golf Course. Treated effluent will be piped from the Bluffton Regional WWTP to a holding tank at Colleton River Plantation, where it will be applied to the golf courses.

BJW&SA Rose Hill WWTP has been eliminated; and is now being used as a lift station. Wastewater is pumped to the Okatie Water Reclamation plant and reclaimed water is returned to be spray irrigated at its Equestrian Paddocks area, Rose Hill Golf Course, Western Nine Fairways, Block "X", Block "B-6", Belfair Plantation golf course, and Old Carolina Golf Links.

BJW&SA Bluffton WWTP is a 0.435 MGD plant that disposes of treated effluent at the Hilton Head National golf course and Colleton River Plantation golf course. This plant is in the process of being eliminated and the facility will be used to store reclaimed water.

B. **Industrial wastes -** There are no permitted industrial discharges in Area 18.

C. **Marinas** - S.C. Regulation 61-47, Shellfish defines Marina as "any water area with a structure (docks, basin, floating docks, etc.) which is: 1) used for docking or otherwise mooring vessels; and, 2) constructed to provide temporary or permanent docking space for more than ten boats, or has more than 200 linear feet of docking space." There are no marinas in Area 18.

D. **Radionuclides -** Sources of radionuclides have not been identified within Area 18, and radionuclide monitoring has not been conducted. No other sources of poisonous or deleterious substances have been identified within the area.

NONPOINT SOURCE POLLUTION

A. **Stormwater -** Widening of SC Highway 170 from the Academy for Career Excellence to its intersection with SC Highway 278 is underway. Stormwater from the road is directed through existing drainage ditches and eventually to the Okatie River. Land clearing and construction has begun at two new developments adjacent to the Okatie, Berkeley Hall and Old Field. Development of the Buckwalter tract has begun. A new road connecting Highway 278 and Highway 46 has been built. Two new schools have been built adjacent to Highway 46. Construction of single family homes is continuing at Del Webb? s Riverbend site on the Okatie River. This 232 acre site will have 316 lots for single family homes. The site will have a community dock but no boat ramp and all homes are on sewer.

In Area 18, stormwater canals drain large areas of land south of Highway 278 to the Colleton River, and areas west of Highway 170/278 to the Okatie. Stormwater runoff following rainfall may be contributing to high fecal coliform concentrations at station 08 in the headwaters of the Okatie. Some impact is also apparent at the two new stations in the Okatie, 16 and 17, which are located near tributaries which receive stormwater. Stormwater coming from a drainage ditch which extends north of Highway 170 may also be impacting water quality in Chechessee Creek. Stormwater runoff impacts water quality by transporting fecal coliform bacteria (and other pollutants) from land to the shellfish growing area. Stormwater from roads, residences, and agricultural land is directed to the lowest point of elevation which is typically the nearest creek or marsh. In addition, there are freshwater wetland areas, ditches, and impoundments which drain into tidal creeks.

Most land disturbing activities in South Carolina must comply with the Stormwater Management and Sediment Reduction Act of 1991. The final regulations, effective on June 26, 1992, establish the procedures and minimum standards for a statewide stormwater management program. For activities in the eight coastal counties, additional water quality requirements are imposed. For all projects, regardless of size, which are located within one-half mile of a receiving water body in the coastal zone, the criteria for permanent water quality ponds having a permanent pool is that they are designed to store the first ? inch of runoff from the entire site over a 24-hour period or storage of the first one inch of runoff from the built-upon portion of the property, whichever is greater. Storage may be accomplished through retention, detention, or infiltration systems, as appropriate for the specific site. In addition, for those projects which are located within 1000 feet of shellfish beds, the first one and one half inches of runoff from the built-upon portion of the property must be retained on site. Since 1992, these regulations have been applied to the development of residential subdivisions, golf courses, and business areas.

B. **Agricultural Waste -** A herd of cattle is located near the headwaters of the Okatie River. A waste management plan has been developed to control runoff to the river. Manure from 14 horses and two mules is collected, mixed with sawdust and applied to land at Spring Island. The SCDNR Waddell Mariculture Center is a mariculture research facility located adjacent to the Colleton River, which pumps water out of and discharges it back to the Colleton River.

C. **Individual Sewage Treatment and Disposal (ISTD) Systems -** The majority of homes in Area 18 utilize sewer for wastewater disposal. Older homes adjacent to the Okatie River and Chechessee Creek areas utilize ISTDs.

D. **Wildlife and Domestic Animals -** This area supports populations of white-tailed deer, raccoons, wading birds, migratory waterfowl, and other wildlife, which may contribute to fecal coliform levels in some areas. Domestic animals present in the area include dogs, cats, horses, and goats.

E. **Boat Traffic -** The Colleton River and Chechessee Creek provides access to Broad River and

Port Royal Sound and the Atlantic Ocean for commercial and recreational vessels.

F. Hydrographic and Habitat Modification - Hydrographic and habitat modification in estuarine areas requires both State and Federal approval.

G. Marine Biotoxins - There have been no documented occurrences of toxic algae affecting water quality in Area 18. The Department participates in a State Task Force on Toxic Algae and maintains a toxic algae emergency response team.

HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS

PHYSIOGRAPHY

Area 18 is part of the Broad River estuary, which is a drowned river valley system and the largest of Sea Island Coastal Region estuaries (219 square kilometers). This estuary, which includes Broad River, Beaufort River, Port Royal Sound, and several tidal tributaries, includes an extensive system of marshes, tidal creeks, and sea islands. The average depth of the estuary is approximately 7 meters at mid tide level. Broad and deep natural channels exist throughout Port Royal Sound, Beaufort River, and major tidal tributaries. Large shoal areas occur primarily in the Beaufort River and Port Royal Sound (NOAA, 1994).

Tides - Tides in Area 18 are semidiurnal, consisting of two low and high tides each lunar day. Mean tidal range is 5.9 feet during normal tides and 6.9 feet during spring tides. The greatest tidal ranges of the year typically occur around full moon during the months of September through December. There is considerable variation in the normal tide range due to the prevailing strength and direction of winds.

Rainfall - Rainfall data used in this survey is collected at a weather station located at the BJW&SA Southside WWTP (station 380559- Beaufort 7 SW). Rainfall is recorded at 7 AM (for the period of 7 AM of the previous day to 7AM of the date shown in the table). As most shellfish samples are collected after 7:00 AM, the rainfall for the sample date + 24 hours has been added to the rainfall summary table. Rainfall for the sample date + 24 hours may correlate better and help to explain elevated fecal coliform concentrations in sample results, particularly if there was zero rainfall on the date of or prior to sampling.

Annual rainfall recorded at the Beaufort 7SW weather station was significantly below the 30-year normal amount for 2000 and 2001 (see Chart Beaufort Annual Rainfall). Below normal rainfall continued through May 2002 and by August 2002, the drought status of all 46 counties in the state, including Beaufort and Colleton, had been upgraded to extreme. Above normal rainfall beginning in late August, however, led the S.C. Drought Response Committee to downgrade the drought status statewide and remove the drought declaration for Beaufort, Charleston, and Colleton counties on November 21, 2002.

Annual rainfall is normally about 51.15", with August being the wettest month. Charts showing yearly rainfall amounts for the years 1998 through 2003 are attached. Approximately 40% of the annual rainfall falls in the three month period from June to August. Weather patterns during this time period are often characterized by thunderstorms and shower activity of a short duration. In addition, these three months also have the highest numbers of days with rainfall greater than 1". The months of December through March historically have the greatest number of days with rainfall exceeding 0.10" and 0.50". Rainfall events during these months are typically of a longer duration.

The effects of El Niño were first experienced as early as March of 1997, in the form of decreased rainfall. Rainfall amounts were below normal until mid-summer when the warm phase El Niño effects were observed in the form of above normal rainfall. The full influence of El Niño with regard to rainfall was observed in the fall, when amounts were recorded in excess of the 30 year average. This 'warm and wet' trend continued through April 1998. The 102 year (1895-1996) El Niño average rainfall for November to March for this region of S.C. is about 125% of the normal rainfall amount.

Winds - The prevailing wind direction between February and September ranges between South and South Southwest (180 to 200 degrees) and between October and January is North Northeast (20 degrees). The annual mean wind speed is 8.5 MPH, with August having the lowest (7.3 MPH) and March the highest (10.0 MPH) mean wind speed.

River discharges - There are no freshwater rivers that discharge directly into Area 18. The salinity structure of the Broad River estuary is primarily determined by the seasonal freshwater discharge from the Coosawhatchie and Pocotaligo Rivers and mean salinities vary less than 5 ppt between typical high and low salinity periods.

WATER QUALITY STUDIES

DESCRIPTION OF THE PROGRAM

The Department currently utilizes a systematic random sampling (SRS) strategy within Area 18 in lieu of sampling under adverse pollution conditions. In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period. Sampling dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather. Day of week selection criteria is limited to Mondays, Tuesdays, and Wednesdays due to shipping requirements and laboratory manpower constraints. Sample schedules are rarely altered.

During July, 1998, an updated data analysis procedure was formalized. Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36 month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples

per station yet provides a six sample ? cushion? (above the NSSP required 30 minimum) for broken samples, lab error, breakdowns, etc. This also allows each annual report to meet the NSSP Triennial Review sampling criteria.

Six hundred and nine (609) surface water quality samples (<1.0 ft. deep) were collected for bacteriological analyses and classification purposes at 17 active water quality sampling stations in Area 18 during the period 01/01/01 through 12/31/03. The samples were collected in 120 ml amber glass bottles, immediately placed on ice and transported by bus to the South Carolina Department of Health and Environmental Control's Trident District Environmental Quality Control laboratory at North Charleston, South Carolina or the Low Country District Environmental Quality Control laboratory at Beaufort, South Carolina. An additional 120 ml water sample was included with each shipment as a temperature control. Upon receipt at the laboratory, sample sets that exceeded a 30-hour holding time or contained a temperature control >10 degrees C. were discarded. Samples collected after September 1, 1986 have been analyzed using the five tube/three dilution modified A-1 method described by Nuefeld (1985).

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using automatic temperature compensated refractometers. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling. Tidal stages were determined Nautical Software? s Tides and Currents, Version 2 (1996).

The report, *A Baseline Assessment of Environmental and Biological Conditions in Broad Creek and the Okatie River, Beaufort County, South Carolina* was published in the spring of 2000. The study, conducted by SCDHEC, SCDNR, and the NOAA National Ocean Service, involved a comprehensive assessment of overall water quality, sediment quality, and biological conditions of the two study areas. The report states that system wide, fecal coliform bacteria concentrations were higher in Broad Creek than in the Okatie River. Biotyping of the fecal coliform samples that had *E. coli* indicated that Broad Creek had both a higher incidence of *E. coli* in the in the samples and a higher percentage of antibiotic resistant strains that were indicative of human sources than the Okatie River. There was also a clear association of areas with high *E.coli* counts related to human sources and obvious pollution sources (land application of treated wastewater and septic tanks) in Broad Creek. However, the majority of stations in both Broad Creek (53.3%) and the Okatie River (80%) were negative for the antibiotic resistance tests used for typing probable sources. This suggests that animal wastes are a major contributor of the fecal coliform levels observed in both systems (SCDHEC, 2000).

MONITORING RESULTS

Stations 01, 02, 03, 04, 05, 06, 07, 11, 12, 13, 14, 15, 16, and 17 do not exceed a fecal coliform MPN geometric mean value of 14 nor a fecal coliform MPN estimated 90th percentile value of 43 and therefore meet the statistical criteria for an Approved classification. Stations 08, 09, and 10 exceed a fecal coliform MPN geometric mean value of 14 or a fecal coliform MPN estimated 90th percentile value of 43, thus meeting the statistical criteria for a Restricted classification.

CONCLUSIONS

Based on review of fecal coliform bacteriological data and the pollution source survey, Area 18 is impacted by two sources of actual or potential pollution.

NONPOINT SOURCE RUNOFF

Stormwater runoff appears to be the major source of fecal coliform bacteria contamination in Area 18. The area is experiencing rapid development. Large tracts of forest and farm land adjacent to the Colleton and Okatie Rivers are in the process of being developed. Increases in impervious surface result in an increase in the volume of stormwater runoff which transports fecal coliform bacteria and other pollutants to shellfish waters.

Possible sources of fecal coliform bacteria contamination include pets, wildlife, domestic animals such as horses and cows, failing septic systems, and drainage from roads and freshwater wetlands.

INDIVIDUAL SEWAGE TREATMENT AND DISPOSAL SYSTEMS

Almost all homes adjacent to shellfish waters in Area 18 are served by ISTDs. Soils in most areas are considered to be suitable for ISTDs and systems should operate properly if maintained. However, many older homes with "grandfathered" systems may not meet current standards.

RECOMMENDATIONS

Water quality at Station 08, near the headwaters of the Okatie River, meets the statistical criteria for a Restricted classification, with a 90^{th} percentile value of 58. The downgrade in water quality classification subsequent to the previous Annual Update is the apparent result of a return to normal rainfall patterns. Water quality at Station 8 is impacted by rainfall and stormwater runoff. The Okatie River, from the headwaters to Station 16, is recommended to retain a Restricted classification.

Water quality at Station 09 - at the first (unnamed) tributary in Chechessee Creek from Colleton River - meets the statistical criteria for a Restricted classification, with an estimated 90^{th} percentile value of 44. Water quality at this station is impacted by rainfall and runoff from stormwater ditches in the Bailey's Circle area. The existing Restricted area should remain in place, extending from the west side of the causeway and bridges to Callawassie Island to Station 03, at the confluence with the Okatie River.

Water quality at Station 10 - the second bridge to Callawassie Island - meets the statistical criteria for a Restricted classification, with a 90^{th} percentile value of 51. It is recommended that the harvesting classification of Chechessee Creek between stations 10,11, and 14 be downgraded to Restricted.

The shoreline survey and bacteriological data review of Shellfish Management Area 18 indicate

that changes in classification boundary descriptions are necessary. The following harvest classification of Area 18 is recommended:

Prohibited: None

Restricted/No Depuration: None

Restricted:

1. Chechessee Creek, from Station 03 at its confluence with Okatie River to Station 14, including stations 09,10, and 11

2. Okatie River, from its headwaters to Station 16, at the confluence of the Pinckney Colony tributary

Approved: The remaining waters of Area 18.

Station Addition/Deactivation/Modification: None.

Analysis of sampling data for Area 18 demonstrates the probability of a significant impact from rainfall exceeding 4.00" in a 24 hour period. Therefore, a precautionary closure of area 18 will be implemented following rainfall events of greater than 4.00" in a 24 hour period, as measured at the Beaufort-7-SW Weather Station. This methodology is associated with the concept of the Probable Maximum Precipitation (PMP). PMP estimates for the coastal United States has been published in a series of hydro-meteorological reports (HMRs) by the National Weather Service (*National Weather Service*). PMP estimates for South Carolina's growing areas are derived from HMRs 51, 52, and 53 (*National Research Council, 1985*).

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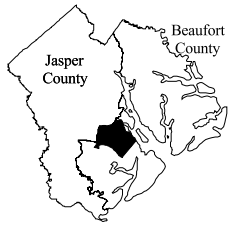
TABLE #1
Shellfish Management Area 18
WATER QUALITY SAMPLING STATIONS DESCRIPTION

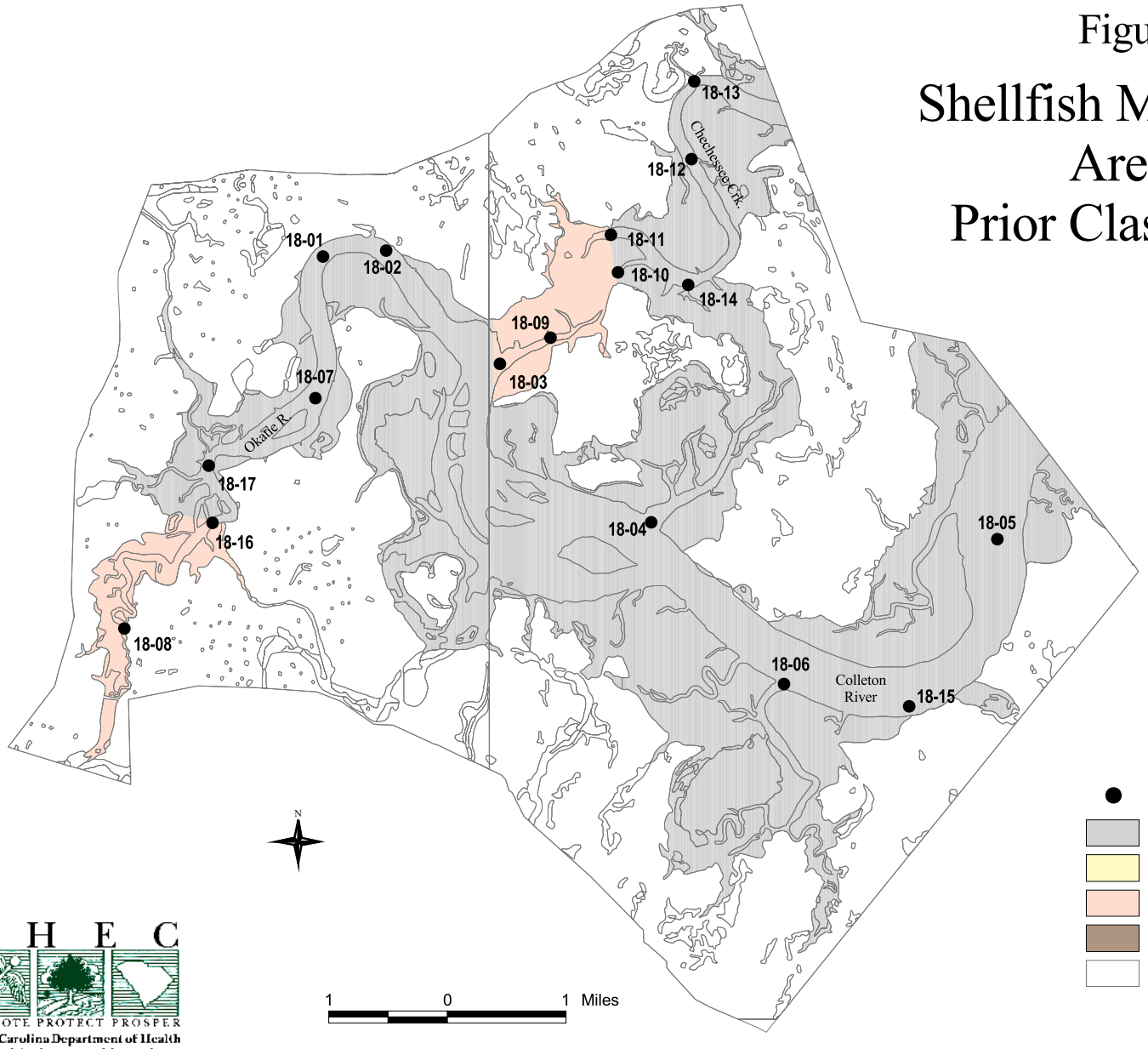
Station	Description
01	Okatie River at Camp St. Mary's Dock
02	Okatie River Behind Bailey's Oyster Dock
03	Chechessee Creek at Okatie River
04	Callawassie Creek at Colleton River, Mouth of Creek
05	Callawassie Creek at Colleton Creek at Tree Line
06	Sawmill Creek at Colleton Creek
07	Okatie River at Indigo Plantation
08	Okatie River at Dock Without House
09	First Unnamed Tributary in Chechessee Creek from Colleton River
10	Second Bridge to Callawassie Island
11	First Bridge to Callawassie Island
12	Series of Unnamed Tributaries in Chechessee Creek
13	First Unnamed Tributary to Chechessee Point in Chechessee Creek
14	Tributary from Spring Island Shrimp Pond
15	Dock at Waddell Mariculture Center
16	Okatie River at confluence of Pinckney Colony tributary
17	Okatie River at confluence of Cherry Point tributary

(Total 17)

Figure 1.

Shellfish Management Area 18 Prior Classification





- Monitoring Sites
- Approved
- Conditionally Approved
- Restricted
- Prohibited
- NWI Quads

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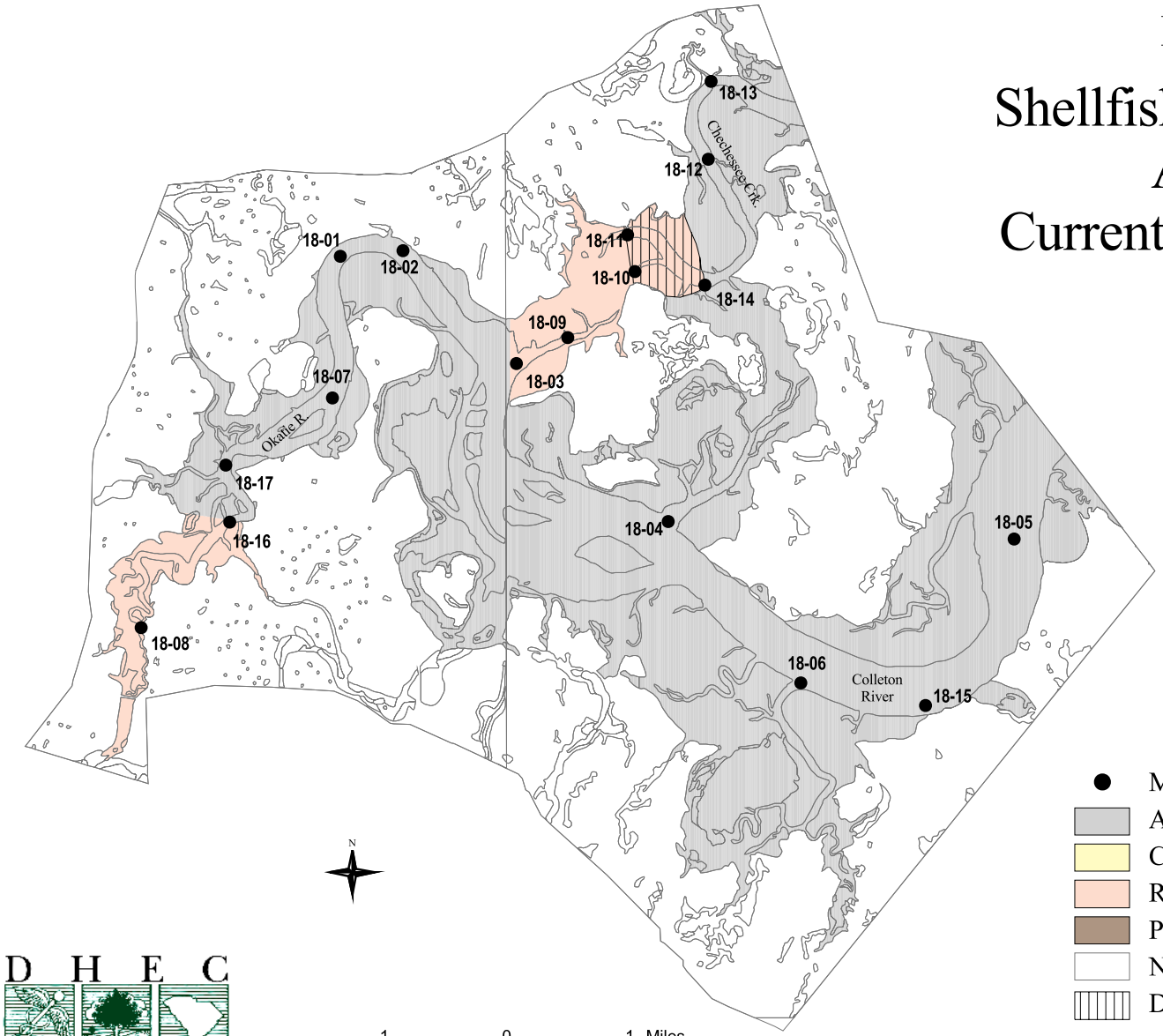
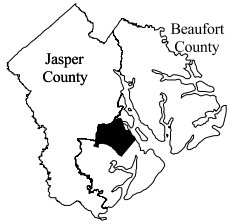
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Figure 2.

Shellfish Management Area 18 Current Classification





- Monitoring Sites
- Approved
- Conditionally Approved
- Restricted
- Prohibited
- NWI Quads
- Downgraded Classification

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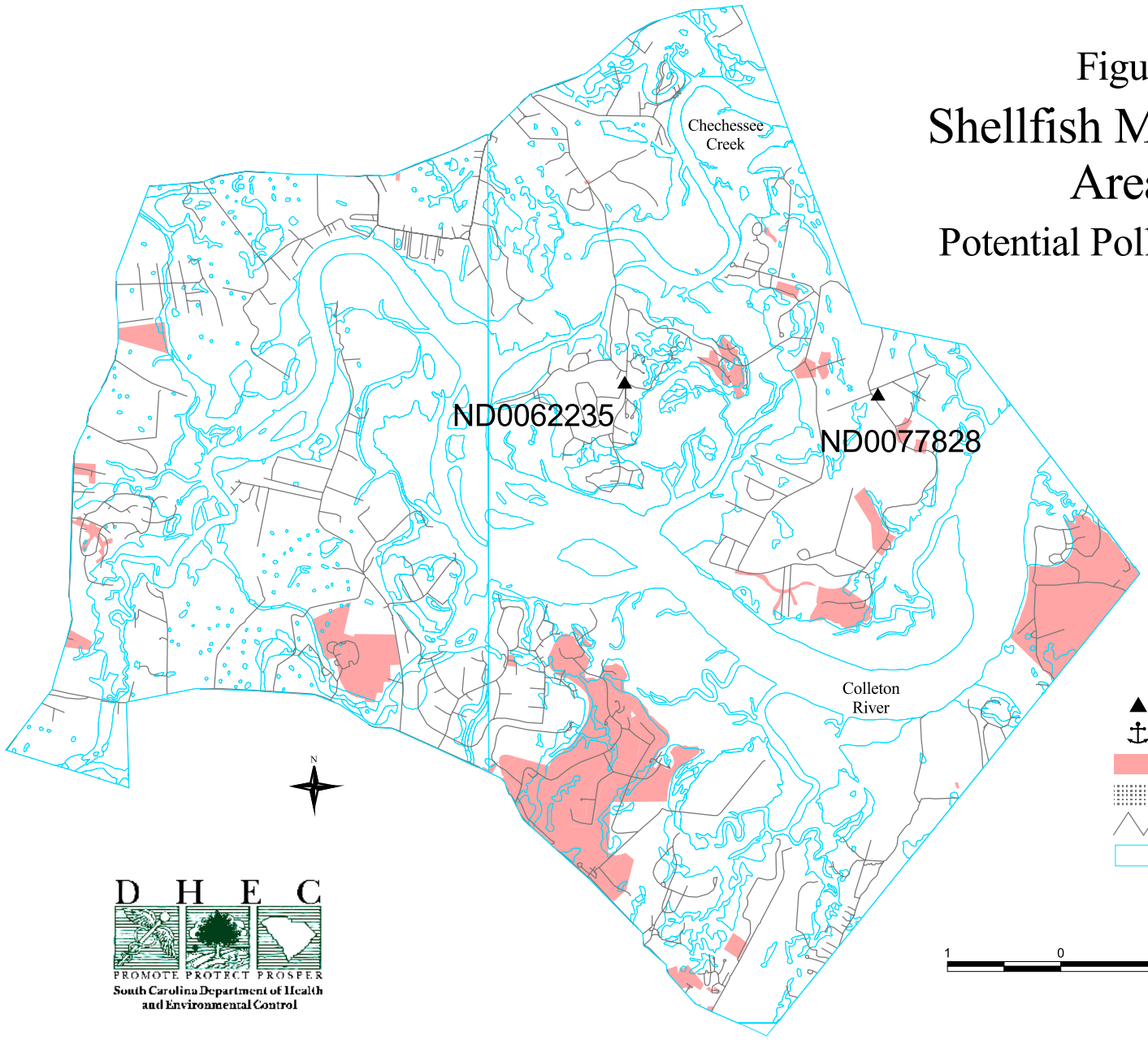
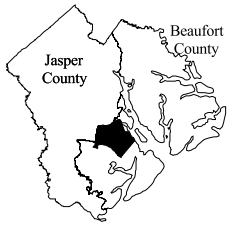
Figure 3.
Shellfish Management Area 18
Potential Pollution Souces





- NPDES Discharge
- Marina/Docking Facilities
- Storm Water Permits
- Corporate Limits
- County Roads
- National Wetland Inventory

1 0 1 2 Miles

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

TABLE #2
Shellfish Management Area 18

FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY
from Shellfish Water Quality Sampling Stations between

January 1, 2001 and December 31, 2003

Station #?	1	2	3	4	5	6	7	8	9	10	11
SAMPLES	36	36	36	35	35	36	36	36	36	36	35
GEOMEAN	4.3	3.4	4.5	3.7	2.9	3.3	4.9	8.1	8.0	9.1	6.8
90TH %ILE	15	9	15	9	6	10	17	56	44	51	35
WATERQLTY	A	A	A	A	A	A	A	R	R	R	A
CLASSIFICATION	A	A	R	A	A	A	A	R	R	R	R

Station #?	12	13	14	15	16	17					
SAMPLES	36	36	35	36	36	36					
GEOMEAN	4.8	4.5	6.2	3.8	6.9	5.7					
90TH %ILE	18	15	24	9	35	27					
WATERQLTY	A	A	A	A	A	A					
CLASSIFICATION	A	A	R	A	R	A					

Station #?											
SAMPLES											
GEOMEAN											
90TH %ILE											
WATERQLTY											
CLASSIFICATION											

A - Approved **CA** - Conditionally Approved **R** - Restricted
RND - Restricted/No Depuration **P** - Prohibited

TABLE #3

Water Quality
Sampling Stations Data

Shellfish Management Area 18

BACTERIOLOGICAL DATA

Data for each shellfish station listed in this report's "Fecal Coliform Bacteriological Data Summary Table" and in other shellfish reports, can be obtained through South Carolina's Department of Health and Environmental Control - Freedom of Information office at the address below.

Freedom of Information
2600 Bull Street
Columbia, SC 29201

Any explanation or clarity needed on the report's content can be obtained by contacting the preparer(s), and/or reviewer(s) listed on the cover page.

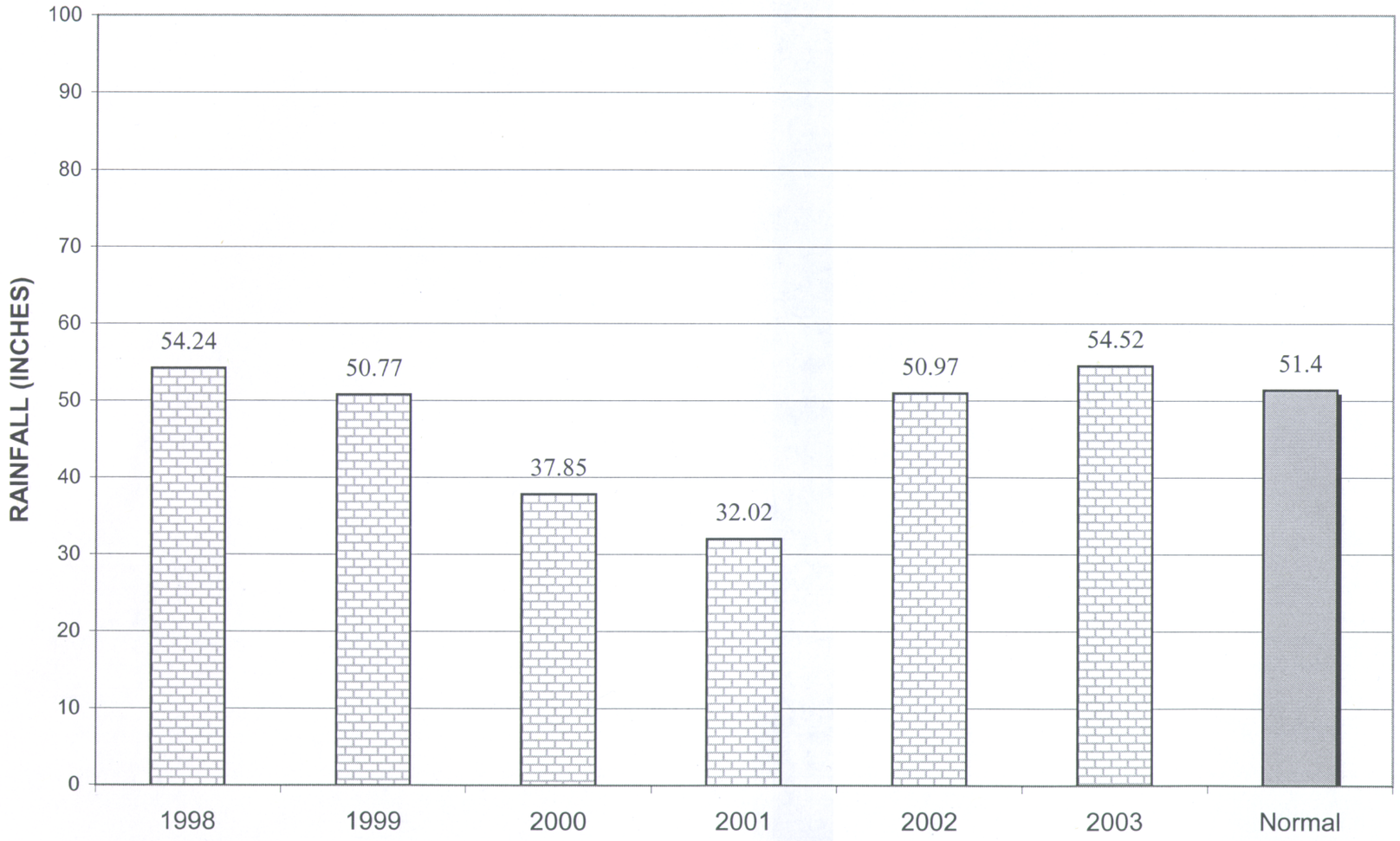
TABLE #4

Rainfall Data

Shellfish Management Area 18

SOURCE : NOAA/National Weather Service
National Climatic Data Center, Asheville, North Carolina 28801

BEAUFORT ANNUAL RAINFALL 1998-2003



ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: City of Beaufort Wastewater Treatment Plant

Beaufort, SC (Station #380559 / 7-SW)

2001	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.00	0.00	0.00	0.00	0.00	--	0.00	0.00	--	0.00	0.00	0.00
2nd	0.00	0.00	0.00	0.00	0.00	--	0.04	0.00	--	0.00	0.00	0.00
3rd	0.00	0.00	0.03	0.00	0.00	--	0.02	0.00	--	0.00	0.00	0.00
4th	0.00	0.18	0.85	0.04	0.00	0.41	0.42	0.00	0.75	0.00	0.00	0.00
5th	0.00	0.08	0.02	0.00	0.00	--	0.59	0.01	1.30	0.00	0.00	0.00
6th	0.00	0.00	0.00	0.00	0.00	--	0.00	0.10	0.13	0.00	0.00	0.00
7th	0.00	0.00	0.00	0.00	0.00	--	0.00	0.00	0.23	0.25	0.00	0.00
8th	0.02	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.23	0.00	0.00	0.00
9th	0.31	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.02	0.00	0.00	0.48
10th	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.02	0.05	0.00	--	0.00
11th	0.00	0.06	0.00	0.00	0.00	0.05	0.00	--	0.00	0.00	--	0.63
12th	0.10	0.70	0.00	0.00	0.00	1.30	0.00	0.00	0.05	0.02	0.00	0.06
13th	0.09	0.06	0.77	0.00	0.00	--	1.06	1.58	0.00	--	0.00	0.00
14th	0.00	0.02	0.00	0.20	0.00	0.20	0.28	0.66	0.00	--	0.00	0.00
15th	0.00	0.00	0.15	0.00	0.00	--	0.00	0.00	0.00	0.00	0.00	--
16th	0.00	0.00	0.80	0.20	0.00	--	0.00	0.00	0.00	0.00	0.00	--
17th	0.00	0.11	0.00	0.00	0.00	--	0.00	0.00	0.00	0.00	--	0.00
18th	0.03	0.00	0.00	0.00	0.00	0.04	0.00	2.37	0.00	0.00	--	0.07
19th	0.00	0.00	0.00	0.00	0.00	--	0.00	2.30	0.00	0.00	0.00	0.00
20th	0.45	0.00	1.05	0.00	0.00	0.22	0.00	0.45	0.00	--	0.00	0.00
21st	0.00	0.00	0.51	0.00	0.00	0.11	--	1.02	0.00	--	0.00	0.00
22nd	0.00	0.03	0.00	0.00	0.00	0.00	--	0.00	--	0.00	0.00	0.00
23rd	0.00	0.35	0.00	0.00	0.05	0.04	0.03	0.00	--	0.00	--	0.00
24th	0.00	0.00	0.00	0.00	0.00	0.05	1.00	0.00	0.04	0.00	0.00	0.02
25th	0.00	0.00	0.01	0.00	0.00	--	1.10	0.00	0.90	0.00	0.03	0.00
26th	0.00	0.06	0.00	0.27	0.00	0.28	0.03	0.00	0.01	0.00	0.00	0.00
27th	0.00	0.00	0.00	0.00	0.00	0.28	0.08	0.00	0.00	0.00	0.00	0.00
28th	0.00	0.01	0.00	0.00	0.00	0.01	--	0.00	0.00	--	--	0.00
29th	0.00		0.21	0.00	0.00		--	0.00	0.00	0.00	0.00	0.00
30th	0.00		0.95	0.00	0.40		0.00	0.02	0.00	0.00	0.00	0.00
31st	0.80		0.03		0.00		0.00			0.00		0.00
(Monthly Figures)									**Year's Rainfall Total:**		**32.02**	
SUM	1.80	1.66	5.38	0.71	0.45	3.57	4.65	8.53	3.71	0.27	0.03	1.26
MAX	0.80	0.70	1.05	0.27	0.40	1.30	1.10	2.37	1.30	0.25	0.03	0.63
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.06	0.06	0.17	0.02	0.01	0.22	0.17	0.29	0.15	0.01	0.00	0.04

Note:"--" denotes missing data

(Shellfish Management Areas 14, 15, 16A, 16B, 17, 18, 19)

ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: City of Beaufort Wastewater Treatment Plant

Beaufort, SC (Station #380559 / 7-SW)

2002	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.00	0.00	0.00	2.60	0.00	0.00	--	0.81	0.65	0.05	0.00	0.00
2nd	0.10	0.00	--	0.00	0.00	0.00	0.00	0.02	0.06	0.15	0.00	0.00
3rd	0.50	--	--	0.00	0.00	0.00	0.00	--	0.16	0.00	0.00	0.00
4th	0.08	0.00	0.05	0.00	--	0.00	0.00	0.02	0.00	--	0.00	0.00
5th	--	0.00	0.00	0.00	0.00	0.00	0.00	--	0.00	--	0.25	0.00
6th	--	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.78	0.13
7th	0.00	1.01	0.00	0.00	0.00	0.00	--	0.49	0.00	0.02	0.04	--
8th	0.00	0.25	0.00	0.02	--	0.00	0.00	0.00	0.00	0.00	0.00	--
9th	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--
10th	0.00	0.27	0.00	0.41	0.00	0.00	0.28	0.00	--	1.85	1.12	0.73
11th	0.00	0.15	0.00	0.04	0.00	0.00	0.00	0.00	0.00	--	0.00	0.35
12th	0.00	0.00	0.00	--	0.00	0.00	2.16	0.00	0.00	0.04	1.20	0.04
13th	--	0.00	0.35	0.00	0.00	0.00	--	0.00	--	0.04	0.89	0.56
14th	0.00	0.00	0.00	0.00	0.11	0.00	0.60	0.07	0.90	0.05	0.00	0.03
15th	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.02	0.00	0.00
16th	0.00	--	--	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17th	0.00	--	--	0.00	0.00	--	0.00	--	0.00	0.00	1.59	0.00
18th	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.25	0.22	0.00	0.03	0.00
19th	--	0.00	0.00	0.00	1.10	0.63	0.00	0.02	0.16	0.00	0.00	0.04
20th	--	0.00	0.00	0.00	0.00	3.85	--	0.00	0.11	0.00	0.00	0.20
21st	0.00	0.21	0.18	0.00	0.00	1.21	1.97	0.00	0.00	0.00	0.00	0.02
22nd	0.10	0.00	0.20	0.00	--	0.01	0.00	0.00	0.58	0.00	0.09	0.00
23rd	0.01	0.01	0.00	0.00	0.00	0.76	0.85	0.00	1.20	0.00	0.00	0.00
24th	0.00	0.04	--	0.00	0.00	0.92	0.01	0.04	0.00	0.09	0.00	0.08
25th	0.01	0.00	0.00	0.00	--	0.78	0.60	0.84	0.84	0.09	0.00	1.33
26th	0.14	0.00	0.00	--	0.00	0.01	0.00	0.30	0.51	0.00	0.00	0.00
27th	0.00	0.00	0.48	--	0.00	0.00	0.00	--	--	0.00	0.00	0.00
28th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	--	--	0.49	0.00	0.00
29th	0.00		0.00	0.00	0.00		0.00	2.23	2.05	0.38	0.00	0.00
30th	0.00		0.00		0.00		0.00	1.50		0.00	0.00	0.00
31st	0.00		--		0.00		0.00					0.00
(Monthly Figures)									**Year's Rainfall Total:**		**50.97**	
SUM	1.34	1.96	1.29	3.14	1.21	8.19	6.48	6.59	8.00	3.27	5.99	3.51
MAX	0.50	1.01	0.48	2.60	1.10	3.85	2.16	2.23	2.05	1.85	1.59	1.33
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.05	0.08	0.05	0.12	0.04	0.30	0.24	0.26	0.32	0.12	0.20	0.13

Note:"--" denotes missing data

(Shellfish Management Areas 14, 15, 16A, 16B, 17, 18, 19)

ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: City of Beaufort Wastewater Treatment Plant

Beaufort, SC (Station #380559 / 7-SW)

2003	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.32	0.00	0.00	0.00	0.00	1.00	0.02	0.00	0.22	0.00	0.00	0.00
2nd	0.00	0.00	0.47	0.00	0.00	0.00	0.61	0.14	0.00	0.00	0.00	0.00
3rd	0.00	0.00	0.01	0.00	0.10	0.00	0.84	0.00	0.00	0.00	0.00	0.00
4th	0.00	0.02	0.33	0.00	0.03	0.86	0.00	0.00	0.03	0.00	0.06	0.47
5th	0.00	0.03	0.08	0.00	0.00	0.51	0.03	0.56	0.02	0.00	0.05	0.44
6th	0.00	0.00	0.02	0.03	0.00	0.00	0.01	0.00	2.10	0.00	0.00	0.00
7th	0.00	0.42	1.04	0.09	0.43	0.16	0.00	0.30	0.15	0.01	0.00	0.00
8th	0.00	0.03	0.55	0.96	0.00	0.70	0.05	0.00	0.27	0.02	0.00	0.00
9th	0.00	0.00	0.02	1.26	0.00	0.36	0.00	0.00	0.15	0.07	0.00	0.00
10th	0.00	0.12	0.01	0.72	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.00
11th	0.00	0.31	0.00	0.15	0.00	0.00	0.00	0.02	0.00	0.02	0.00	--
12th	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13th	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00
14th	0.00	0.00	0.56	0.00	0.00	0.66	0.11	0.00	0.00	0.00	0.00	0.33
15th	0.00	0.00	0.21	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00
16th	0.00	0.00	0.15	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17th	0.00	1.40	0.02	0.00	0.12	0.25	0.00	0.08	0.00	0.00	0.00	0.02
18th	0.00	0.05	0.38	0.00	1.92	0.26	0.00	0.36	0.00	0.07	0.00	0.00
19th	0.00	0.00	0.10	0.00	2.80	1.14	0.00	2.42	0.00	0.00	0.00	0.00
20th	0.00	0.00	0.11	0.00	0.00	0.00	3.95	0.00	0.00	0.00	0.36	0.00
21st	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00
22nd	0.03	0.02	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23rd	0.23	0.58	0.00	0.00	3.01	0.00	0.00	0.00	0.25	0.00	0.00	0.00
24th	0.00	0.00	0.00	0.00	0.00	0.00	1.85	0.00	0.05	0.00	0.00	0.04
25th	0.00	0.00	0.00	0.00	0.04	0.00	1.29	0.16	0.00	0.00	0.00	0.00
26th	0.00	0.00	0.00	1.34	0.16	0.00	0.62	0.51	0.00	0.00	0.00	0.00
27th	0.00	0.45	0.00	0.46	0.11	0.00	0.20	0.03	0.00	0.00	0.00	0.00
28th	0.00	0.09	0.01	0.00	0.00	0.00	0.63	0.00	0.00	0.25	0.00	0.00
29th	0.00		0.00	0.00	0.00	1.00	0.36	0.00	0.00	2.60	0.21	0.00
30th	0.00		0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00
31st	0.00		0.30		0.00		0.00	0.00		0.00		0.00
(Monthly Figures)									**Year's Rainfall Total:**		**54.52**	
SUM	0.58	3.52	4.75	5.08	9.00	7.05	11.17	5.07	3.28	3.04	0.68	1.30
MAX	0.32	1.40	1.04	1.34	3.01	1.14	3.95	2.42	2.10	2.60	0.36	0.47
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.02	0.13	0.15	0.17	0.29	0.24	0.36	0.16	0.11	0.10	0.02	0.04

Note:"--" denotes missing data

(Shellfish Management Areas 14, 15, 16A, 16B, 17, 18, 19)

Shellfish Management Area 18
A SUMMARY OF RAINFALL
DURING AND PRIOR TO FECAL COLIFORM SAMPLING

Sample Date	Sample Date + 24 hours	Sample Date	Sample Date - 24 hours	Sample Date - 48 hours	Sample Date - 72 hours
01/23/01	0.00"	0.00"	0.00"	0.00"	0.45"
02/21/01	0.03"	0.00"	0.00"	0.00"	0.00"
03/06/01	0.00"	0.00"	0.02"	0.85"	0.03"
04/03/01	0.04"	0.00"	0.00"	0.00"	0.00"
05/08/01	0.00"	0.00"	0.00"	0.00"	0.00"
06/26/01	no data	0.05"	0.04"	0.00"	0.11"
07/25/01	0.03"	1.10"	1.00"	0.03"	no data
08/06/01	no data	0.10"	0.01"	0.00"	0.00"
09/11/01	0.05"	0.00"	0.05"	0.02"	0.23"
10/17/01	0.00"	0.00"	0.00"	0.00"	no data
11/12/01	0.00"	0.00"	no data	no data	0.00"
12/04/01	0.00"	0.00"	0.00"	0.00"	0.00"
01/22/02	0.01”	0.10”	0.00”	no data	no data
02/13/02	0.00”	0.00”	0.00”	0.15”	0.27”
03/11/02	0.00”	0.00”	0.00”	0.00”	0.00”
04/01/02	0.00”	2.60”	no data	0.00”	0.00”
05/07/02	no data	0.00”	0.00”	0.00”	no data
06/17/02	0.00”	no data	0.00”	0.00”	0.00”
07/09/02	0.28”	0.00”	0.00”	no data	0.01”
08/12/02	0.00”	0.00”	0.00”	0.00”	0.00”
09/16/02	0.00”	0.56”	0.90”	no data	no data
10/14/02	0.05”	0.04”	0.04”	no data	1.85”
11/14/02	0.00”	0.00”	0.89”	1.20”	0.00”
12/03/02	0.00”	0.00”	0.00”	0.00”	0.00”
01/13/03	0.00”	0.00”	0.00”	0.00”	0.00”
02/03/03	0.02”	0.00”	0.00”	0.00”	0.00”
03/19/03	0.11”	0.10”	0.38”	0.02”	0.15”
04/14/03	0.00”	0.00”	0.00”	0.00”	0.15”
05/13/03	0.00”	0.00”	0.08”	0.00”	0.00”
06/04/03	0.51”	0.86”	0.00”	0.00”	1.00”
07/16/03	0.00”	0.00”	0.21”	0.11”	0.39”
08/19/03	0.00”	2.42”	0.36”	0.08”	0.00”
09/08/03	0.15”	0.27”	0.15”	2.10”	0.02”
10/13/03	0.00”	0.00”	0.00”	0.02”	0.00”
11/03/03	0.06”	0.00”	0.00”	0.00”	0.00”
12/15/03	no data	no data	0.33”	0.00”	0.00”

[Amounts Shown Are per Day, not Cumulative] Station 380559-Beaufort 7 SW